

# Elucidating food webs in infralittoral rocky coastal habitats invaded by *Caulerpa cylindracea* (Sonder 1845)

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## Introduction

The Mediterranean Sea is one of the most affected areas worldwide by invasive alien species, representing up to 5% of the described flora and fauna (1). New inhabitants modify natural and local communities occupying native ecological niches through predation or competition. Macroalga *Caulerpa cylindracea* Sonder, 1845, native from the southwestern coast of Australia, has broadly colonized soft bottoms, seagrass meadows and rocky shores ranging from 0 up to 70 m (2).

Lampedusa Island, in central Mediterranean Sea is a hotspot for assessing invasive alien species with an interesting scenario since *C. cylindracea* and invasive herbivorous fish *Siganus luridus* are co-existing.

Stable Isotopes Analysis (SIA) techniques can be used to study effects of invasive species in food webs in a rapid and cost-effective way. The presence of a new basal resource such as *C. cylindracea* would be expected to create a greater degree of trophic diversity with higher carbon and nitrogen isotopic values having implications at community and ecosystem level.

## Aims

- ✓ Describe food webs in invaded and non- invaded conditions in coastal rocky bottoms in Lampedusa Island, Central Mediterranean
- ✓ Test the hypothesis that the introduction of a new source of primary production and basal resource can cause an enlargement of trophic niche within the food web

## Results

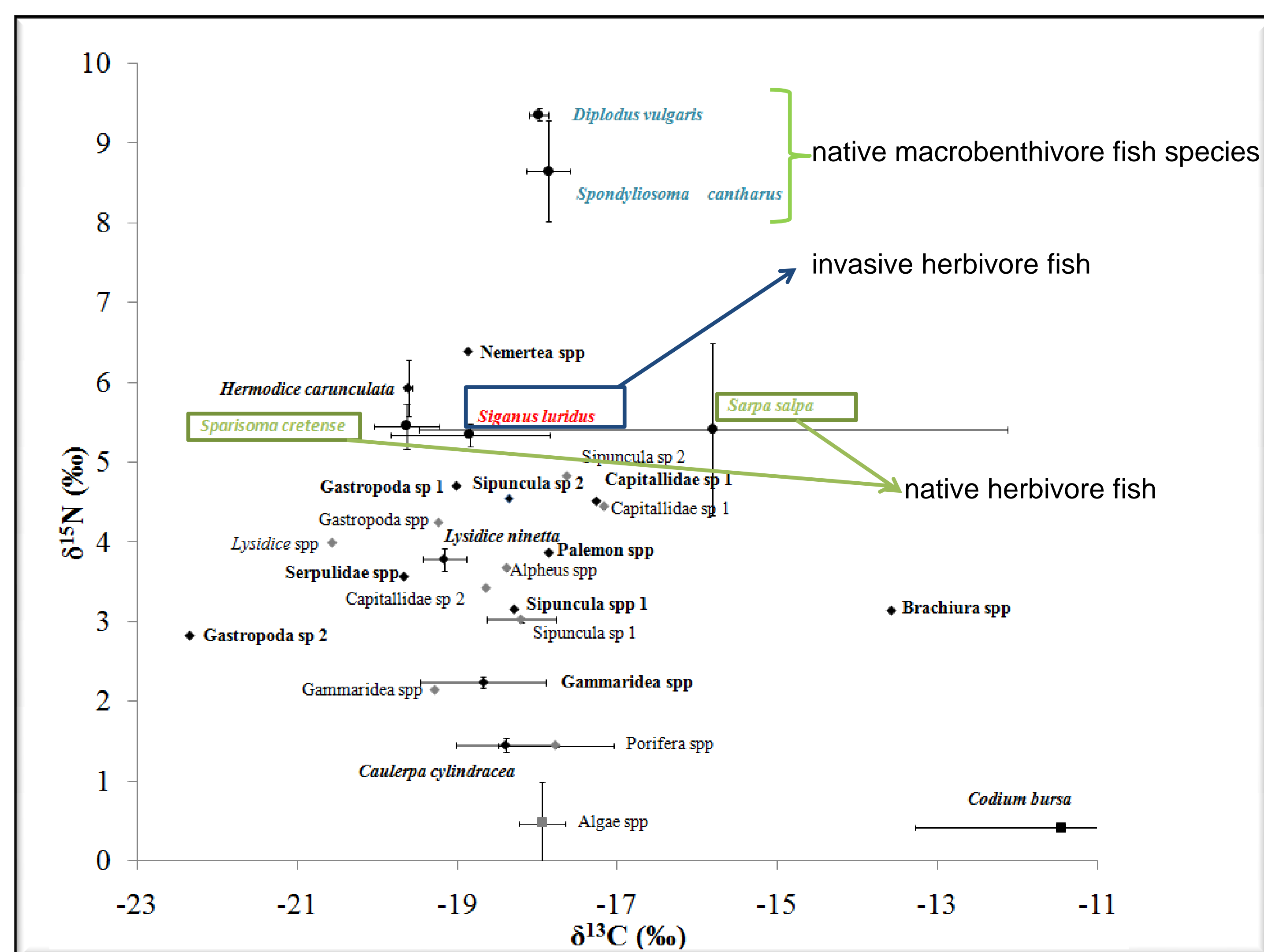


Fig. 1-Mean SIA values: slightly higher in invaded than in non-invaded conditions (invaded;  $\delta^{13}\text{C} = -17.94 \text{ ‰}$  and  $\delta^{15}\text{N} = 3.60 \text{ ‰}$  and non-invaded;  $\delta^{13}\text{C} = -18.48 \text{ ‰}$  and  $\delta^{15}\text{N} = 3.14 \text{ ‰}$ ; t-test  $p > 0.05$ )

## Discussion and conclusions

✓ Macrobenthic community in invaded conditions shows slightly higher carbon and nitrogen isotopic values than in non-invaded conditions (Fig. 1)

✓ Bionvasion by *Caulerpa cylindracea* causes an enlargement of trophic niche of at least 1.4 times in coastal rocky infralittoral habitats (Fig. 2)

## Material and Methods

### Field work

Scuba diving with visual census at Lampedusa Island during highest biomass of *Caulerpa cylindracea* in November 2013

Two invaded hard substrate surfaces by *C. cylindracea* (frequency > 0.9) and two rocky surfaces colonized by native macroalgae (frequency > 0.9) were sampled at depths between 9.5 and 11.5 meters

Samples of macroalgae (*C. cylindracea*, *Codium bursa*) and invertebrates (*Hermodice carunculata*, *Palaemon* spp, *Lysidice* spp, and different species of Brachyura, Capitellidae, Gammaridea, Gastropoda, Nemertea, Porifera, Serpulidae, Sipuncula) were obtained

Macrobenthivore native fish species *Diplodus vulgaris* and *Spondyllosoma cantharus* were sampled to investigate the presence of an indirect effect at higher trophic levels due to *C. cylindracea*. To investigate the direct trophic effect, native herbivore fishes *Sparisoma cretense* and *Sarpa salpa* and the herbivore Lessepsian species *S. luridus*, were also sampled by spear fishing in the same surfaces for benthic sampling

### Stable Isotopes Analyses (SIA)

$\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  stable isotopes signals were determined in all biological samples with a continuous flow mass spectrometer (Thermo Finnegan Delta x-plus)

Isotopic niche enlargement was calculated applying Layman metrics for all biological data and the convex hull area was added to the plot for comparison between invaded and non-invaded conditions (3)

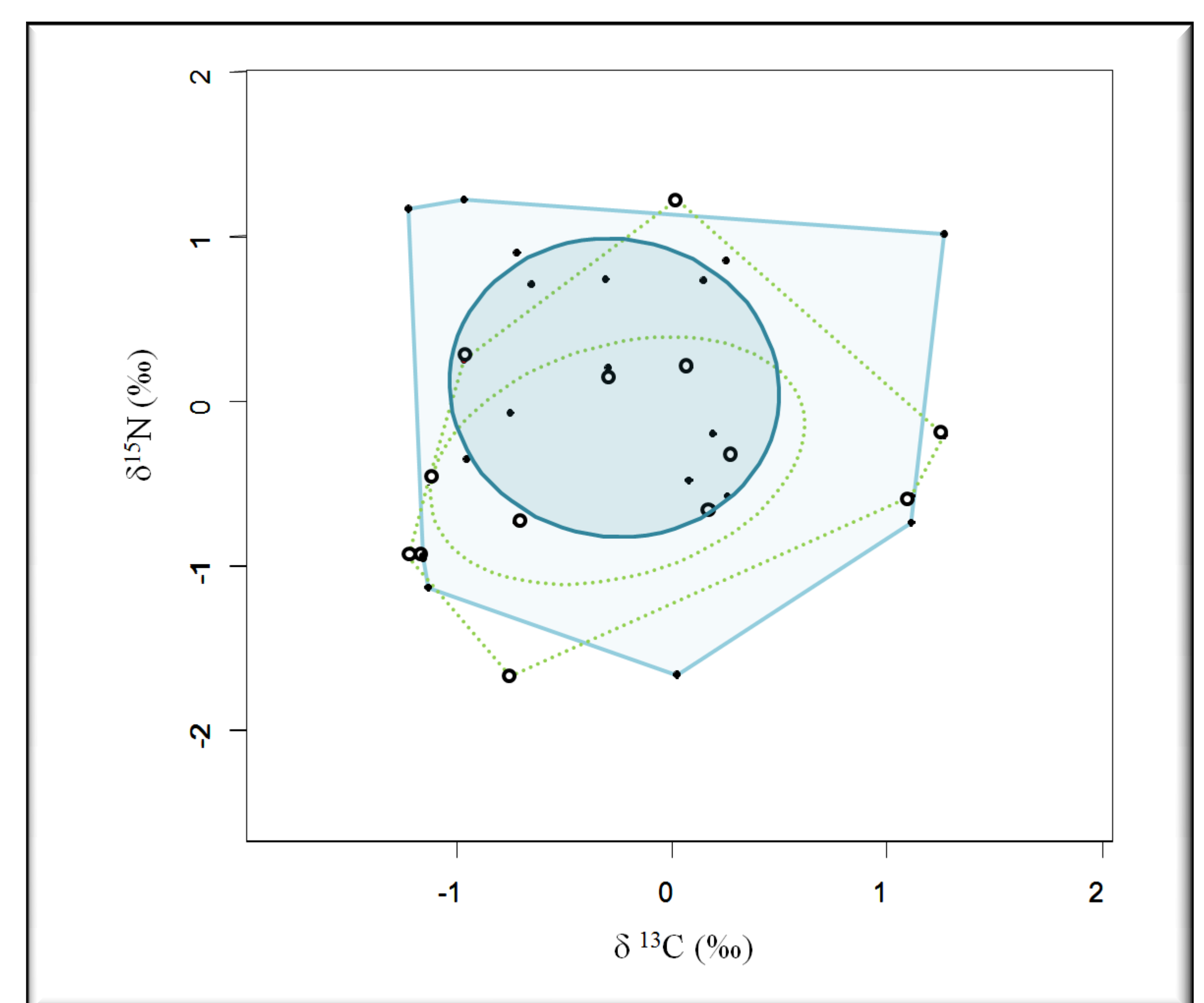


Fig. 2-Trophic diversity according to the convex hull area (irregular shapes) and Bayesian estimate of the standard ellipse area (ellipse shapes) for non-invaded conditions (green and isotopic values =  $\circ$ ) and invaded conditions (blue and isotopic values =  $\bullet$ ).

## Acknowledgements

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## References

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